[1277] In another embodiment, an initial actuation of the lever handle **5046** away from the housing **5109** actuates the carrier to an occluding position prior to actuating the valve into a non-occluding position.

[1278] FIG. **351** shows an optical sensor **5113** for estimating parameters of a fluid line in accordance with an embodiment of the present disclosure. FIG. **352** shows the optical sensor **5113** of FIG. **351** with a fluid line **5063**. Light is shined into a waveguide **5059**. The position of the tube **5063** affects the light that travels within the waveguide **5059**. A diffuser **5061** causes some of the light to leave the waveguide **5059**. That is, total internal reflection prevents light from leaving the bottom surface of the waveguide **5059** into the air. As shown in FIG. **352**, the tube **5063** greatly increases the amount of light that leaves the waveguide **5059**, which affects the amount of light that leaves the diffuser **5060** at various positions. The light out **5061** is monitored by an image sensor **5062** to determine where and how much of the light leaves the diffuser **5060**, which is used to measure the contact of the tube **5063** with the diffuser **506**. As shown in FIG. **352**, there will be less light out as the tube **5063** pulls in light which results in dimmed light on the right side (of FIG. **352**) of the diffuser **5060**. The image sensor **5062** may use this data to determine the shape of the tube **5063** and to estimate its volume. The image sensor **5062** may be coupled to the RTP **3500** of FIG. **324**. In some embodiments, a plunger (e.g., plunger **3091** of FIG. **297**) includes the waveguide **5059**, the diffuser **5060**, and/or the image sensor **5062** to measure a tube **5063** parameter. The plunger may be clear. In yet additional embodiments, the waveguide **5059**, the diffuser **5060**, and/or the image sensor **5062** may be positioned in a platen (e.g., platen **3022** of FIG. **297**). The platen may be clear.

[1279] The image data from the image sensor **5062** may be used to measure the volume delivered, the extent of change in a tube **5063** that is being crushed as part of the pumping mechanism, and/or the extent of water boundaries in a contained portion of the tube **5063** (e.g., between inlet and outlet valves). A polarizer may be used in front of the image sensor **5062** to enhance the image.

[1280] In some embodiments, two polarizes are used on both sides of the tube **5063** to determine the edges of the tube **5063** (e.g., using a birefringence effect) as determined by analyzing the image data of the image sensor **5062**. The polarizers may polarize light orthogonal to each other. Stress birefringence creates colored interference pattern with a light source, e.g., white light source. The varying indices of refraction through the material of the tube **5063** cause differing patterns of constructive and destructive interference. In some embodiments, monochromatic light may used. In yet additional embodiment, the image data of the image sensor **5062** is used to estimate the width of the tube **5063** using its stress profile. In yet additional embodiments, two patterns (e.g., grid patterns) are used on both sides of the tube **5063** to determine the edges of the tube **5063** (e.g., using Moiré patterns) as determined by analyzing the image data of the image sensor **5062**. In yet additional embodiments, the image sensor **5062** detects particles within the tube **5063**.

[1281] As shown in FIG. **353**, light guides can be layered **5064** to provide a variety of information to the images sensor **5062**. Each layer can use different polarizations, orientations colors, etc. to provide a suite of spatially distinct information to the camera **5062**.

[1282] FIGS. **354-355** show the operation of a tube restoring apparatus **5088** in accordance with an embodiment of the present disclosure. The apparatus **5088** includes a first end **5083** and a second end **5082** that squeeze a tube **5082** to ensure its round shape. The ends **5082**, **5083** may be coupled to a back **5088**. As a plunger **5085** compresses the tube **5082** (see FIG. **355**), the plunger **5085** pushes the ends **5082**, **5083** away from the tube **5082**. When the plunger **5085** is retracted, a spring action causes the ends **5082**, **5083** to restore the shape of the tube **5082**.

[1283] FIGS. **356-357** show the operation of a tube restoring apparatus **5114** in accordance with an embodiment of the present disclosure. The apparatus **5114** includes a first end **5091** and a second end **5092** that squeeze a tube **5090** to help the tube **5090** maintain a round shape. The ends **5091**, **5092** may be coupled to a common point **5089**. As a plunger **5093** compresses the tube **5090** (see FIG. **357**), the plunger **5093** pushes the ends **5091**, **5092** away from the tube **5091**. When the plunger **5093** is retracted, a spring action causes the ends **5091**, **5092** to restore the shape of the tube **5090** as shown in FIG. **356**.

[1284] FIG. **358** shows a circuit **7000** for storing data within an RFID tag **7008** associated with an infusion pump (e.g., the infusion pump **2990** of FIG. **255**) in accordance with an embodiment of the present disclosure. The RFID tag **7009** of FIG. **358** may be the RFID tag **3670** of FIG. **325**C. The antenna **7001** of FIG. **358** may be the antenna **3955** of FIG. **325**C.

[1285] The antenna **7001** is coupled to an RFID tag **7008** such that an RFID reader (i.e., RFID interrogator) can communicate with the RFID tag **7008**. The circuit **7000** may be placed on a 1×1 PCB inch board with a solid-metal ground plane of the back side.

[1286] An inner loop **7002** with a capacitor **7003** may form a split-ring resonator to enhance the read range capability of the circuit **7000**. The RFID tag **7008** may be coupled to the antenna **7001** via an impedance matching network **7004**, **7005**, **7006**, **7007**. The circuit **7000** may be configured for use with a 900 Megahertz RFID reader.

[1287] A reader chip **7009** may interface with the RFID tag **7008** to write data (e.g., log data) thereto. The reader chip **7009** may communicate with the RFID tag **7008** using I2C, a CAN bus, or other communications link. Alternatively, **7009** may be a electrical connector, in some embodiments.

[1288] FIG. **359** shows an equivalent circuit **7010** for impedance as seen from the RFID tag **7008** of FIG. **358** in accordance with an embodiment of the present disclosure. A loop **7011** shows the antenna **7001** of FIG. **358**. The inductor **7012** shows the inductor **7004** of FIG. **358**. The resistors **7013** and **7014** are schematic representations of the resistors **7006** and **7005**, respectively. The capacitor **7015** shows the capacitor **7007** of FIG. **359**. The circuit elements **7012-7015** are used for impedance matching so that the RFID tag **7008** is efficiently coupled to the loop antenna **7001** such as in the circuit **7000** of FIG. **358**.

[1289] FIG. **360** shows another circuit **7016** for storing data within an RFID tag **7022** associated with an infusion pump (e.g., the infusion pump **2990** of FIG. **255**) in accordance with an embodiment of the present disclosure. The antenna **7017** is shown. The RFID tag **7022** of FIG. **360** may be the RFID tag **3670** of FIG. **325**C. The antenna **7017** of FIG. **360** may be the antenna **3955** of FIG. **325**C.

[1290] The antenna **7017** may have capacitors coupled to the gaps in the antenna **7017**, in some embodiments. An impedance matching network **7018**, **7020**, **7021** may be used to efficiently couple the RFID tag **7022** to the antenna **7017**. An interface **7023** may be used to communicate with the RFID tag **7022** (e.g., an I2C interface, a CAN interface, etc.). FIG. **361** shows a split-ring resonator **7026** used with the circuit of FIG. **360** in accordance with an embodiment of